



The ability to act – Multiple suicidal gunshot wounds

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ABSTRACT

Multiple self-inflicted gunshot wounds are rare and usually present a challenge to the forensic pathologist in determining the manner of death. Determining a person's capability to act following a gunshot wound can be of major importance in crime scene reconstruction and in differentiation between homicide and suicide. Questions concerning the possibility of physical activity following a given gunshot wound are repeatedly raised in court. We report herein three unusual cases of suicide involving multiple gunshot wounds; all the victims suffered gunshot wounds of the head without immediate incapacitation. In the first two cases, the head was target for two gunshots. Third case was a combination of two gunshots to the head and chest. In the text, we focus on the victim's ability to act after the first shot, with regards to the character and localization of the gunshot wound. Also, we focus on findings that are typical for a repeated suicidal shot.

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1. Introduction

It is generally claimed that a single gunshot wound,^{1–3} located in those parts of a body where the victim would expect vital organs is typical for suicides committed with a gun. Therefore, the head and thorax are the target of the majority of the gunshot in suicides.^{1,2,4} However, this statement does not be absolutely applied to all cases. One shot need not necessarily have an immediate fatal effect and the victim might pull the trigger several times.⁵ Multiple gunshot suicides have been published in the form of case reports^{6–13} or as a series.^{4,5,14–17}

Multiple gunshot wounds discovered by examining the victim's body on the crime scene arouse meaningful suspicions of participation by another person in the victim's death, and in absolute majority of such cases the subsequent investigations did confirm homicide. The following text describes three cases of multiple suicidal gunshot wounds, focusing on characteristic features indicating suicide, the victim's ability to act after the first shot and findings that are typical for a repeated shot.

2. Case reports

2.1. Case 1

While having an argument, a 43-year-old man shot his wife with a pistol (model CZ 45, calibre 6.35 mm) with two shots into her

chest region and then he turned the gun against himself and shot himself twice into the right part of the head. During the inspection of the crime scene, a pistol with an unfired cartridge in the gun chamber and empty magazine, 4 spent cartridges and 2 deformed projectiles were found. An external examination and autopsy of the man's body (184 cm, 89 kg) revealed two gunshot wounds to the head at a distance of 6.5 cm apart (Fig. 1).

2.1.1. Gunshot wound A

The entrance wound was localized in the right frontal region; the character of the entrance wound was of an oval skin defect with a diameter of 7 mm (Fig. 1), with abrasion collar and fouling present at the outer edge of the defect towards the right temporal region, with a soot cavity in the subcutis. The exit wound was located in the frontal region in the midline; the nature of the exit wound was of an oval skin defect with a diameter of 5–6 mm. The wound track connecting both defects ran from the right to the left, slightly upwards from below, through subcutis and upper layer of the squama of the frontal bone, in which a groove of 23 mm in length and 6 mm in width was created.

2.1.2. Gunshot wound B

The entrance wound of oval shape and diameter of 7 mm was localized in the right temporal region (Fig. 1). Around the wound, there was present muzzle mark, fouling and abrasion collar. In subcutaneous tissue was a small soot cavity. In the squama of the right temporal bone, there was an oval-shaped defect with a diameter of 6–7 mm, edged by slit-like spreading-out fracture lines. The wound track ran horizontally from the right to the left,

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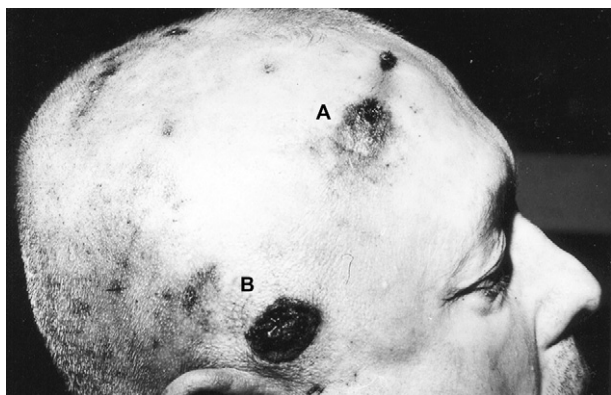


Fig. 1. Case 1: gunshot wounds to male decedent's head.

through bases of both parietal lobes and through basal ganglia bilaterally, with bleeding between brain meninges and into the third brain ventricle. The exit wound was in the left temporal region; the character of the exit wound was of an oval defect of the squama of the left temporal bone with a diameter of 6–7 mm, with edges with external beveling, with oval skin defect of the left temporal region with a diameter of 5–9 mm.

Toxicological investigations revealed a blood alcohol concentration in a femoral vein sample of 1.7 g/L, urine alcohol concentration was determined to be 2.6 g/L. Other toxicological investigations of blood and urine, applying routine methods, were negative. Laboratory methods proved the presence of gunshot residues around both entrance wounds as well as on the right hand.

The immediate cause of the victim's death was brain contusion due to penetration of the projectile. Following the completion of the investigation (interdisciplinary cooperation of police investigators, ballistic expert, crime lab representative) and autopsy, the death was classified as a suicide.

Due to the fact that the first gunshot did not affect brain tissue or any other intracranial structures and that only soft tissues of the frontal face region were harmed (resulting in insignificant damage to the frontal bone), the initial shot most likely did not in any way limit the victim's capability to act. The second shot caused contusion of both cerebral hemispheres and ultimately death (Fig. 2).

2.2. Case 2

The dead body of a 52-year-old man was found lying in the yard of a family farmstead between the rabbit hutch and the shed. During the inspection of the crime scene a pistol (model ČZ 50, calibre 7.65 mm) was found on the roof of the rabbit hutch, 30 cm from its upper edge (Fig. 3). The chamber of the pistol contained an unfired cartridge; the magazine contained more 3 unfired cartridges; the striking mechanism of the pistol was drawn and ready to shoot upon pulling of the trigger. A suicide note was not found. External examination and autopsy of the victim's body (175 cm, 80 kg) discovered two gunshot wounds, one in the facial region and one in the left part of the chest.

2.2.1. Gunshot wound A

The entrance wound was found at the base of the chin (dimensions 3 × 2 cm) with muzzle imprint in the shape of letter "U" and a soot cavity in subcutis. The wound track ran from below upwards through mandible and maxilla, and the exit wound was found on the nose (Fig. 4). In the course of the wound track there were discovered lacerations of soft tissues in oral vestibule, comminuted fractures of both jawbones with devastation of dental

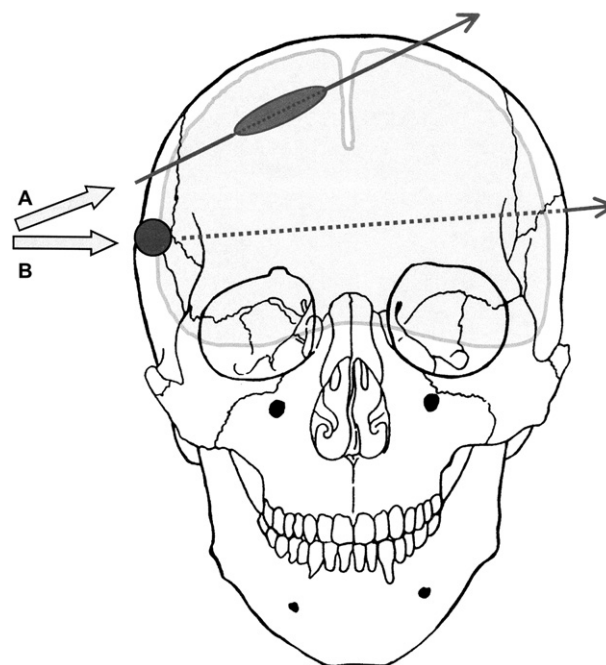


Fig. 2. Case 1: gunshot wounds to male decedent's head – paths of the bullets.

arches and nasal bones, and slight bleeding under pia mater in the region of frontal lobes of cerebral hemispheres.

2.2.2. Gunshot wound B

The loose-contact entrance wound was found in the left thoracic area near the left nipple (diameter 1 cm, Fig. 5). The wound track ran from the front to the back, slight downwards from above, went through the frontal thoracic wall at the height of the 6th intercostal area, through pericardium, the wall of the left heart ventricle and the both left lung lobes. 1800 ml of fluid as well as clotted blood was discovered in the left pleural cavity. The exit wound (diameter of 1.2 cm) was found below the left shoulder blade.

Toxicological investigations revealed a blood alcohol concentration in a femoral vein sample of 2.61 g/L, urine alcohol concentration was determined to be 3.06 g/L. Other toxic, narcotic or psychotropic substances were not proved.

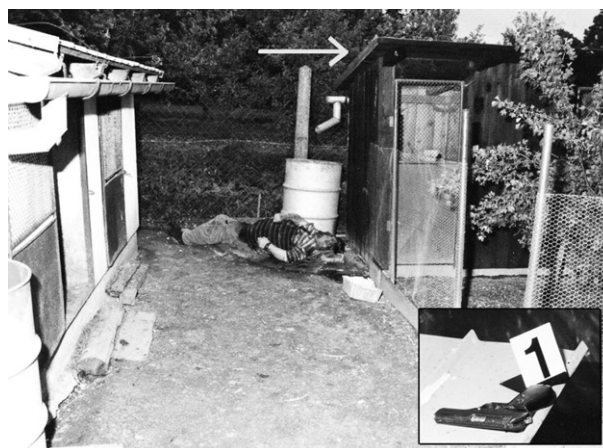


Fig. 3. Case 2: male decedent lying in the yard of a family farmstead between the rabbit hutch and the shed. Used pistol found on the roof of the rabbit hutch.

The immediate cause of the victim's death was internal and external bleeding due to penetration of the heart and left lung. Following the completion of the investigation (interdisciplinary cooperation of police investigators, ballistic expert, crime lab representative) and autopsy, the death was classified as a suicide.

The first shot completely missed the cerebral part of the skull and only caused injury to the facial part of the head. The man, who most probably did not correctly estimate the direction of the shot, could have had his ability to act limited to some extent, but probably only by experiencing very strong pain. The second shot against the heart area then hit the heart and caused bleeding from the left heart ventricle. Even after this second shot the victim's ability to act could have been preserved for a certain time, at least to the extent that he could put the gun on the top of the nearby rabbit hutch, where it was later found.

2.3. Case 3

An 82-year-old pensioner was found dead in his permanent residence sitting in an armchair at the entrance door to the flat. The fingers of the man's right hand freely touched a revolver (model ALFA 620). The revolver cylinder contained 2 spent cartridge cases and 7 other unfired cartridges. A suicide note was found. Subsequent investigation discovered that the man suffered from a malignant prostate gland tumor with generalization into bones of the entire body, causing significant pain during movements.

External examination and autopsy of the dead man's body (179 cm; 72 kg) discovered two gunshot wounds on the head (Figs. 6 and 7).

2.3.1. Gunshot wound A

The entrance wound was localized in the right temporal region (diameter of 5 mm) with muzzle imprint and slight soot cavity in subcutis, at the base of wound a deformed projectile was found (Figs. 6 and 7). In the external layer of the squama of the temporal bone, there was a hardly noticeable groove-like defect.

2.3.2. Gunshot wound B

The entrance wound was found in the right temporal region, 2.5 cm from the previous entrance wound, with muzzle imprint (turned by 90° compared to the previous entrance wound), with slight gas cavity in the subcutis, a rounded defect in the squama of the right temporal bone (diameter 5–6 mm) edged by spreading-out fracture lines. The path of the gunshot wound ran from right to left, slightly from the front to the back and from below upwards, through the right brain lobe, basal ganglia on the right, through the third brain ventricle, basal ganglia on the left and through the left temporal lobe, above the convexity of which a deformed projectile was found (Fig. 7).

Examination of the man's body fluids proved presence of ethyl alcohol in blood (0.59 g/L). Other toxicological investigations of blood and urine, applying routine methods, were negative. Laboratory methods proved the presence of soot and gunpowder particles around the both entrance wounds.

The immediate cause of the victim's death was brain contusion due to the penetration of the bullet. The death was classified as a suicide.

The first shot with low kinetic energy only affected the compactness of the skull; it did not penetrate the cranial cavity and



Fig. 4. Case 2: decedent exhibit self-inflicted gunshot wound to the head. Rod has been placed to show the path of the bullet.



Fig. 5. Case 2: loose-contact entrance wound found in the left thoracic area near the left nipple.



Fig. 6. Case 3: gunshot wounds to male decedent's head.

3. Discussion

The individual's ability to act after the gunshot generally ceases with direct tissue disruption of certain areas of CNS which reduces functioning capability of the central nervous system.¹⁶ Reliable incapacitation can be also achieved indirectly by cerebral hypoxemia from severe bleeding.^{5,16} Direct tissue injury to certain CNS centres leads to immediate incapacitation (upper cervical spinal cord, the brain stem, the cerebellum, large parts of diencephalon and midbrain, the motor cortex and major part of motor conduction). Indirect elimination of CNS due to acute cerebral hypoxemia is caused by severe blood loss, nevertheless oxygen stored in the CNS ensures a potential for physical activity for about 10 s.^{18,19} Targets of rapid incapacitation include the heart, the thoracic aorta and the pulmonary artery. Targets of delayed incapacitation include other major blood vessels and major organs (lungs, liver, spleen, and kidney). Hampered physical activity may be produced by injuries to sensory or optical areas of the CNS, to the spinal cord and large peripheral nerves or to static structures such as long bones or joints.⁵ Ability to act could be also influenced by the type of the used ammunition and gun.¹⁰

Nevertheless, further ability to act voluntarily (e.g. walking, manipulating objects, defence, communication etc.) after a gunshot can be, in some cases (depending on localization of place of the wound, the nature and extent of the injuries suffered, physical and mental characteristics of the victim's body etc.) preserved to various extents and for a relatively long time.

- I. The ability to act after a penetration to the head can be fully preserved or only minimally limited in cases where the central nervous system is not affected by the shot.

- A. The bullet not penetrating the cranial cavity

1. The path of the gunshot completely misses the cranial cavity and affects only the facial part of the skull. For acts of suicide, the cause can be the so-called "wrongly held" gun (gun held to the head at an angle that leads to deflection of the gun barrel axis and thus the shot is

thus did not cause damage to the brain and loss of consciousness. The first shot only opened the way for the next shot, which penetrated the skull and caused fatal damage to brain tissue (Fig. 8).

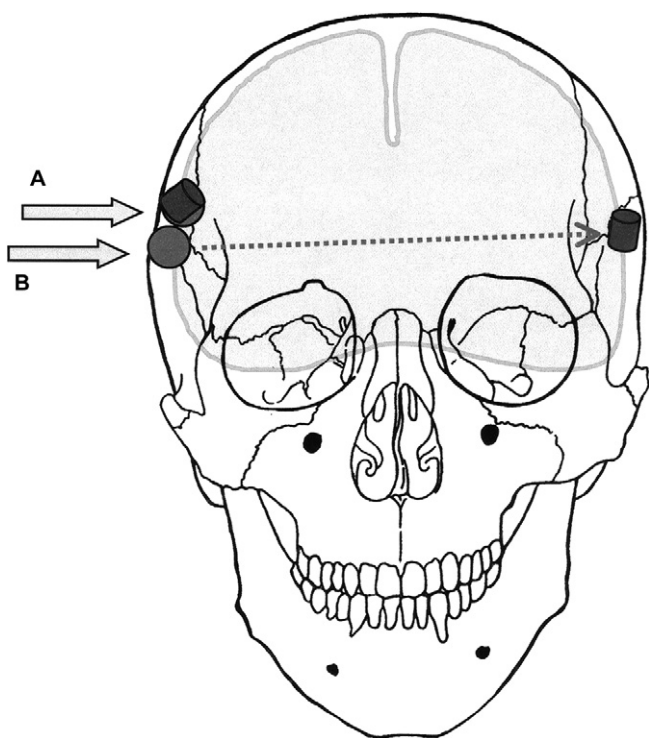


Fig. 7. Case 3: radiograph showing two projectiles in the head.

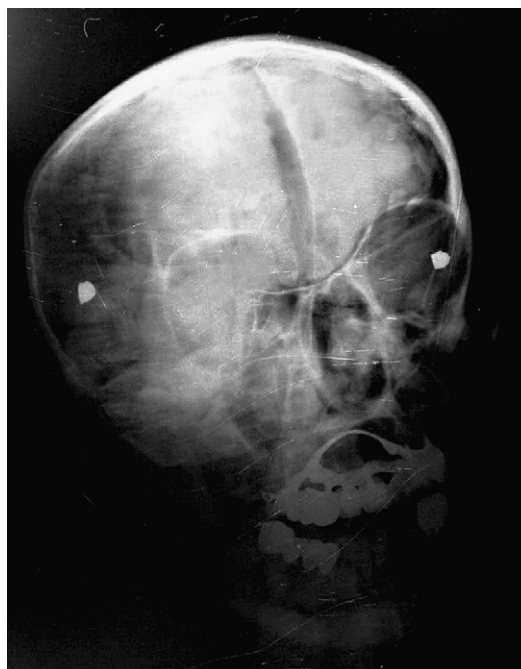


Fig. 8. Case 3: gunshot wounds to male decedent's head – paths of the bullets.

turned away from the cranial cavity) caused by i.e. disturbance, hurry, slipping off or rebounding of the gun after convulsive pulling of the trigger¹¹; incorrect estimation of shot trajectory due to unawareness of anatomic proportions (especially when holding the gun below the chin, when using long guns etc.), when influenced by alcohol or other narcotic substances etc.

2. Biological factor: in some cases strong cranial bone and surrounding soft tissues can (with regard to the type of used ammunition and gun) prevent the shot from penetrating the cranial cavity or deprive it of most of its kinetic energy and thus limit its penetrating effect. The shot can be caught in subcutis or soft cranial layers, neurocranium muscles, external or internal layer of the bone, above the dura mater etc. After the gunshot, the victim need not fall unconscious at all, or there might occur concussion with short unconsciousness, insignificant bleeding between brain meninges etc. In some cases, the victim's ability to act might be limited only by perception of pain, and, in very rare cases, the victim does not even realize the shot at all.
3. Nature of the gun used: the shot does not penetrate the cranial cavity if the shot has low perforating effect, i.e. kinetic energy, due to flegmatization or low laboration of gunpowder, when using guns or ammunition primarily designed for other purposes (²⁰; blank cartridge weapons, air guns, black powder weapons, practice ammunition etc.)

B. The bullet penetrating the cranial cavity or spine

When the projectile penetrates the cranial cavity, further ability to act can be preserved to various extents in cases where the injury is to the so-called "mute" areas of the brain, i.e. areas that do not bear vital centres (temporal and frontal brain lobes, e.g. cross penetration of frontal lobes). In such injuries, the usual symptomatology might be missing: the victim need not necessarily be unconscious and can perform purposive acts of unexpected extent.

Injuries to the spinal cord cause immediate loss of motor abilities due to failure of innervations in limb and torso muscles (paraplegia or quadriplegia, depending on which part of the spinal cord is affected) with mental and sensual functions nonetheless possibly preserved.²¹ Injury to the brain stem is immediately fatal due to failure of vital controlling centres. When the torso is affected, rapid compression of nerve trunks and plexuses along the path of the wound might occur due to hydrodynamic effects, with the subsequent neurogenic shock causing immediate loss of motor abilities (musculature slackening).

II. Further capability to act connected with gunshot wounds to other parts of the body can be preserved for certain time (seconds, minutes, hours, or even days) even in case of injury to one of the following:

1. Heart – When the heart is affected in systole, the contraction of myocardium presents a certain reserve for tissue expansion due to hydrodynamic explosive effect; the volume of blood in ventricles is also much lower compared to diastole: the injury can be of the nature of an individual defect (incomplete penetration), or two (or more) defects that lead to quick but gradual bleeding from cardiac cavities. Also, a tangential injury to the heart can lead to gradual bleeding into the pericardium and pleural cavities, yet the conscious ability to act can be preserved even for several tens of seconds.^{14,22} On the contrary, when the heart is affected in diastole (expansion of ventricle muscles), the hydrodynamic effect causes

a devastating injury to the heart, with virtually immediate loss of ability to act.²¹

2. Neck – Injuries to the neck (except for surface tangential injuries) is almost always connected with rapid loss of further ability to act, due to the presence of vessels supplying brain with oxygenated blood. Rapid incapacitation could be also accomplished by direct damage to the other vital neck organs (e.g. nerve plexuses innervating heart, diaphragm or lungs; lower section of spinal cord; trachea).
3. Lungs – Injury to lung tissue causes a collapse of a lung through internal pneumothorax, which is, however, preceded by external pneumothorax caused by penetrating injury of thoracic wall. In the case of unilateral uncomplicated injury to the lung, the injured person's ability to act, depending on the physical and mental disposition and health condition, can be preserved for several hours or even days. The ability to act under such conditions can be limited by pain and breathlessness (walking of up to several hundred meters has been reported). In the case of tension pneumothorax, pressure on mediastinum occurs due to the accumulation of air in the pleural cavity, with increasing breathlessness and subsequent collapse of the circulatory system within a maximum of several tens of minutes. When lung blood vessels are affected, rapid bleeding into the pleural cavity or bronchial tree (with possible aspiration of blood and choking) occurs. This also happens when intercostal vessels are affected. Bilateral pneumothorax causes rapid loss of ability to act.
4. Abdomen – the loss of ability to act due to shock as a result of spleen and liver injury could depending on its severity.²³ When some "less important" organs are affected (intestines, mesentery, and omenta), the immediate effect of the injury can be limited only to perception of pain; only subsequently (several hours or days later) the ability to act can be limited by infectious complications (painful inflammation of peritoneum, septic condition).
5. Blood vessels – injury of major blood vessels (the thoracic aorta and pulmonary artery) and their main branches causes rapid decrease of blood pressure due to rapid loss of high volume of blood, and rapid loss of ability to act due to unconsciousness in case of acute failure to supply brain tissue with oxygenated blood (certain limited ability to act can occur in approximately 5–10 s after the supply of oxygenated blood to the brain has been interrupted^{18,19}).
6. Periphery – when limbs are affected, the ability to act depends on the extent of the injury to major blood vessels as well as muscle fascicles or the skeleton. Injury to the facial part of the head causes, due to considerable perfusion of this area, significant blood loss, which might lead to aspiration of blood. If the genitals are affected, the person could be disabled due to the perception of pain, but the perception of pain varies in male and female.⁵

In some cases, the victims were described to act very energetically, despite an undoubtedly fatal injury (extensive brain/heart injury), even for several seconds.²³ This can be assigned to instinctive enhancement of the victim's acting, which happens for instance in defensive fighting situations where a predomination of movement automatisms (acting patterns) over voluntary control of the nervous system can be assumed in trained individuals.

On the other hand, the possibility of immediate loss of the ability to act or even the death of the injured person should be discussed in cases of relatively insignificant injuries, e.g. injuries to the skin covering peripheries of the body. In such cases, the mental state of the injured person plays a significant role; i.e. simple realization of having been shot, which can lead to immediate

nervous collapse with cardiac arrest.²³ The loss of the ability to act due to the perception of pain is then determined by the injured individual's sensibility to pain.⁵

The "ability to act" question is mainly discussed when multiple gunshot wounds are present. In the case of the first shot not affecting vital nervous centers, the heart or major blood vessels, the ability to act can be limited virtually only by the perception of pain. A repeated shot can then occur even several tens of minutes later, at a different place, against a different part of the body, or possibly by a different weapon; and the victim could even act consciously. After the first unsuccessful suicide attempt, this person might put the weapon away and choose a completely different way of committing suicide (unplanned complex suicide – hanging, jumping from a height, stabbing).

A repeated unintentional shot can occur when a self-loading gun is used. In such cases, the repeated pulling of the trigger can be caused by: reflexive, involuntary contraction of skeletal muscles of the limb holding the gun after the first shot; forward movement of the gun against the finger on the trigger; the gun hitting surrounding objects when the body falls to the ground following the first shot etc. A repeated shot can also occur when an automatic gun that enables shooting in loads is used – a single pulling of the trigger leads to shooting a load of shots that hit the aimed part of the victim's body. Depending on the length of the load (number of bullets shot), recoil, and also the lowering of the hand holding the gun, the individual gunshot wounds can be located in different positions and at various distances from each other.²⁴ Multiple gunshot wounds to various parts of the victim's body are not an exception. Theoretically, the magazine of the gun can even be completely emptied (e.g. when the body falls on the gun while the trigger is pressed).

The double or more suicidal shots can also occur in cases of the simultaneous use of two firearms.^{25–31}

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Conflict of interest

There is no actual or potential conflict of interest.

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